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10/597,976	08/15/2006	Peter-Andre Redert	NL050010	8767

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P.O. BOX 3001
BRIARCLIFF MANOR, NY 10510

EXAMINER	
PERROMAT, CARLOS	

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2628	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/597,976	Applicant(s) REDERT ET AL.	
	Examiner Carlos Perromat	**Art Unit** 2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 18 February 2009.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-17 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-17 is/are rejected.

7)☒ Claim(s) 2 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments, see p.7, filed 2/18/2009, with respect to the objection to the specification have been fully considered and are persuasive. The objection of the specification has been withdrawn.

The amendment of claim 17 renders the objection moot.

2. Applicant's arguments with respect to claims 16 and 17 have been considered but are moot in view of the new ground(s) of rejection.

The amendment of claims 16 and 17 renders the previous 35 U.S.C. 101 rejections for these claims moot.

3. Applicant's arguments with respect to claims 4 and 16 have been considered but are moot in view of the new ground(s) of rejection.

The amendment to claims 4 and 16 render the previous 35 U.S.C. 112 second paragraph rejections of these claims moot.

4. Applicant's arguments, see p.8, filed 2/18/2009, with respect to the 35 U.S.C. 112 first paragraph rejection of claim 16 have been fully considered and are persuasive. The prior 112 first paragraph rejection of claim 16 has been withdrawn.

5. Applicant's arguments filed 2/18/2009 have been fully considered but they are not persuasive.

Regarding claims 1, 15, 16 and 17, the applicant argues that Numagami does not teach computing cost values, that comprise number and extent of transitions in pixel luminance values along a path, where the path is related to a spatial disposition of

objects in the image, where computing the cost value for a pixel is performed by combining values of pairs of pixels at transitions. Numagami however, as explained in the rejection, teaches determining depth by integrating the slopes along a path between a pixel in an isodensity line, and another pixel in an area between two consecutive isodensitiy lines; see section IV. Since, as admitted by the applicant an isodensity line is a line that connects equal intensity pixels, the area between two isodensity lines is a transition in value. Further Numagami teaches measuring the slope along the path, where the slope is measured by difference in intensity values between the pixels in the path, and therefore, since the values are discrete, the change in intensity value between pairs of pixels along that line, and further, since depth is calculated by integrating these slopes, and again because the values are discrete, inherently requiring measuring the number of transitions in values measured, and the extent, that is distance between the values; see section IV. Finally, Numagami clearly teaches that the path is calculated by calculating the normal of the isodensity line, where this normal is the normal of the object at that line, and therefore, Numagami teaches that the path is related to a spatial disposition of the object, that is, the normal of the object at that point; see section IV. The 35 USC 102 rejection for these claims is therefore maintained.

Regarding the claims 5, 7, 11 and 14, the applicant only argues that they are allowable in virtue of their dependence from claims 1. Since, as mentioned above, claim 1 stands rejected, so do these claims.

Claim Objections

6. Claim 2 is objected to because of the following informalities: Claim 2 recites the expression “consistion” instead of consisting. Appropriate correction is required.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1-4, 6, 8-10, 12, 13, and 15-17 are rejected under 35 U.S.C. 102(b) as being anticipated by Numagami et al. (Numagami, Y.; Kajiwara, Y.; Nakamura, O.; Minami, T., Reconstruction of the 3-D shape of an object from a 2-D intensity image, Canadian Conference on Electrical and Computer Engineering, 1995. Volume: 2, 5-8 Sep 1995 Pages: 1188-1191, provided by applicant, "Numagami” hereinafter).

Regarding claims 1, 15, and 17, Numagami teaches a “method of generating a depth map (122) comprising depth values representing distances to a viewer, for respective pixels of an image (100)” (i.e., a method to reconstruct 3-D shape form a 2-D image, 1st par. of the Introduction, by calculating the heights of pixels, step 2 of section IV), “A depth map generating unit (401) for generating a depth map (122)" (i.e., a computer, see section V, par. 9), and a “computer program product” (inherently, since the method is performed by a computer) for “computing cost values that comprise respective measures of a number of and extent of transitions in luminance and/or color and/or color components for pixels of the image on a path related to a spatial disposition

of objects in the image, wherein computing a cost value for a first one of the pixels (108) of the image by combining differences between values of pixels which are disposed on a path (112) from the first one of the pixels (108) to a second one of the pixels (110) wherein the second one of the pixels belongs to a predetermined subset of the pixels of the image" (i.e., to determine the height of a pixel from a fiducial pixel, where the fiducial pixel belongs to an isodensity line of pixels by combining the values of the pixels along a reconstruction path, section IV, steps 1-3; determining depth by integrating the slopes along a path between a pixel in an isodensity line, and another pixel in an area between two consecutive isodensitiy lines; see section IV. Since, as admitted by the applicant an isodensity line is a line that connects equal intensity pixels, the area between two isodensity lines is a transition in value. Further Numagami teaches measuring the slope along the path, where the slope is measured by difference in intensity values between the pixels in the path, and therefore, since the values are discrete, the change in intensity value between pairs of pixels along that line, and further, since depth is calculated by integrating these slopes, and again because the values are discrete, inherently requiring measuring the number of transitions in values measured, and the extent, that is distance between the values; see section IV. Finally, Numagami clearly teaches that the path is calculated by calculating the normal of the isodensity line, where this normal is the normal of the object at that line, and therefore, Numagami teaches that the path is related to a spatial disposition of the object, that is, the normal of the object at that point; see section IV); "and assigning a first one of the depth values corresponding to the first one of the pixels (108) on basis of the cost value" (i.e.,

assigning the height of the pixel by integrating the slope values of the pixels along the path, where the slope value is dependent on the intensity level of the pixels, section IV, step 2 (iii)).

Regarding claim 2, Numagami further teaches that “the predetermined subset comprises one selected from the group consistion of (i) pixels which are located at a border of the image, (ii) pixels of a part of the border, and (iii) a central pixel of the image” (i.e., the predetermined subset of pixels belongs to an isodensity line of pixels, and this line is not restricted to pixels outside the border of the image, or the central portion of the image; see section III, subsection *Extraction of the isodensity lines*, 1st par.).

Regarding claim 3, Numagami also discloses that “a first one of the differences is equal to a difference between respective values of neighboring pixels which are disposed on the path (112)” (i.e., the slope value of the pixels along the path, where the slop value is dependent on the difference of intensity between the pixels in the path, section IV, step 2 (iii)).

Regarding claim 6, Numagami further discloses that “the cost value for the first one of the pixels (108) is computed by accumulating the differences between the values of the pixels which are disposed on the path (112)” (i.e., the cost is calculated by integrating the slope value along the path, where the slope value depends on the difference in intensity value between the pixels in the path, section IV, step 2 (iii)).

Regarding claim 8, Numagami also teaches that “the cost value for the first one of pixels is computed by accumulating products of differences between the values of the

pixels which are disposed on the path (112) and respective weighting factors for the differences" (i.e., the slope value is compensated by a product of a weight factor, see section IV, subsection *Calculation of the height*, 3rd par., and formula 12).

Regarding claim 9, Numagami further teaches that "a first one of the weighting factors which is related to a difference between a value of a particular pixel and a value of its neighboring pixel, is based on a distance between the particular pixel and the first one of the pixels (108)" (see section IV, subsection *Calculation of the height*, 3rd par., formula 12, and Fig. 5).

Regarding claim 10, Numagami also discloses that "whereby a second one of the weighting factors which is related to a difference between a value of a particular pixel and a value of its neighboring pixel, is based on the location of the neighboring pixel related to the particular pixel" (i.e., the weight factor is based on the angle between the pixels, see section IV, subsection *Calculation of the height*, 3rd par., formula 12, and Fig. 5).

Regarding claim 12, Numagami also teaches "computing a second cost value for a third one of the pixels on basis of the cost value for the first one of the pixels" (i.e., linear interpolation used to fill areas between reconstruction paths, see section V, par. 7 and 8, and fig. 9).

Regarding claim 13, Numagami further teaches "computing the second cost value by combining the cost value of the first one of the pixels with a difference between further values of further pixels which are disposed on a second path from the third one

of the pixels to the first one of the pixels" (i.e., linear interpolation used to fill areas between reconstruction paths, see section V, par. 7 and 8, and fig. 9).

Regarding claim 16, Numagami teaches an "image processing apparatus" (i.e., a computer, see section V, par. 9), "comprising: receiving means (502) for receiving a signal corresponding to an image (100)" (inherently, since the computer processes a 2-D image, which must have been received) "and a depth generating unit (401) for generating a depth map (122), wherein said map generating unit includes computing means for computing cost values that comprise respective measures of a number of and extent of transitions in luminance and/or color and/or color components for pixels of the image on a path related to a spatial disposition of objects in the image, wherein computing includes computing a cost value for a first one of the pixels (108) of the image by combining differences between values of pairs of neighboring connected pixels at transitions which are disposed on a path (112) from the first one of the pixels (108) to a second one of the pixels (110), wherein the second one of the pixels belongs to a predetermined subset of the pixels of the image, and assigning means for assigning a first one of the depth values corresponding to the first one of the pixels (108) on basis of the cost value" (see rejection for claim 1, above).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

> invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 4, 5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Numagami et al. (Numagami, Y.; Kajiwara, Y.; Nakamura, O.; Minami, T., Reconstruction of the 3-D shape of an object from a 2-D intensity image, Canadian Conference on Electrical and Computer Engineering, 1995. Volume: 2, 5-8 Sep 1995 Pages: 1188-1191, provided by applicant, "Numagami” hereinafter) as applied to claim 1 above, and further in view of Cahill et al. (U.S. Patent Publication No. 2004/0062439, “Cahill” hereinafter).

Regarding claim 4, Numagami does not explicitly teach that “a second one of the differences is equal to an absolute value of difference between respective values of neighboring pixels which are disposed on the path (112)”. Cahill also teaches a method of providing depth information from a 2D image, comprising calculating a depth map, see par. [0002], in which values are filtered for noise by using a threshold, see par. [0022]. Because both Numagami and Cahill disclose ways of obtaining 3D information from a 2D image, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the threshold correction to the measurement of intensity difference between pixels disclosed in Numagami. Such a modification would allow the method in Numagami not to produce erroneous depth estimations when a noisy value is encountered, which could result in a relatively flat surface appearing discontinuous in its 3D reconstruction. Obviously, when applying a threshold to the difference in intensity value, the absolute value would be used, since the noisy value could cause both an erroneous negative or positive value.

Regarding claim 5, Numagami also teaches that “the values of pixels correspond to one of luminance (….)” (i.e., the value of the pixel is the intensity of the pixel, section IV, step 2 (iii)). Numagami does not teach that the values of the pixels are measured in terms of color. Cahill however, also teaches a method of generating a depth map, see rejection for claim 4 above, and par. [0002] for color used in conjunction with luminance for segmentation.

Because both Cahill and Numagami teach methods of creating depth maps from a 2-D image, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the pixel evaluation of luminance in Numagami with the alternative evaluation of chrominance taught in Cahill because in luminance measurements, the level of white for every pixel is measured. In chrominance measurements, the levels of the color components are measured. These techniques are equivalent, one applying to grey-level pictures, and the other to color pictures, and well-known in the art.

Regarding claim 7, Numagami discloses that "the cost value for the first one of the pixels (108) is computed by accumulating the differences between the values of the pixels which are disposed on the path (112)” (i.e., the cost is calculated by integrating the slope value along the path, where the slope value depends on the difference in intensity value between the pixels in the path, section IV, step 2 (iii)). Numagami does not teach “the differences being larger than a predetermined threshold”. Cahill however, also teaches a method of generating a depth map, in which the pixel values are adjusted to meet a predetermined threshold, see discussion for claim 4 above.

11. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Numagami et al. (Numagami, Y.; Kajiwara, Y.; Nakamura, O.; Minami, T., Reconstruction of the 3-D shape of an object from a 2-D intensity image, Canadian Conference on Electrical and Computer Engineering, 1995. Volume: 2, 5-8 Sep 1995 Pages: 1188-1191, provided by applicant, "Numagami" hereinafter).

Regarding claim 11, Numagami teaches "computing a second cost value for the first one of the pixels (108) of the image by combining differences between values of pixels which are disposed on a second path (202) from the first one of the pixels (108) to a third one of the pixels (204) which belongs to the predetermined subset of the pixels of the image" (Numagami teaches that its method is performed for every one of the fiducial points found, see section IV, step 3, where a fiducial point is a point of an isodensity line, see section IV, step 1, and there is a plurality of isodensity lines, see fig 2). Numagami does not teach "determining the minimum of the cost value and the second cost value; assigning the first one of the depth values corresponding to the first one of the pixels (108) on basis of the minimum". Although Numagami is silent about how to resolve conflicting cost values for the same pixel, where the cost values have been calculated along the different paths between this pixel and fiducial points in adjacent isodensity lines, the examiner takes the official notice that, where two or more conflicting measurements for a unique value are found, there are a limited number of choices on how to solve said conflict. Therefore it would have been obvious for one of ordinary skill in the art to modify the method disclosed in Numagami, with a choice of

the minimum value when two or more conflicting values are found for the same measurement to resolve this conflict by either choosing the larger value, the lower value or the average value. Arriving at the conclusion that the minimum value is more likely to be correct would have come naturally to one of ordinary skill in the art at the time of the invention after normal testing of the method, if, for example, it was found that the most frequent error in measurement is to overestimate the value for a point.

12. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Numagami et al. (Numagami, Y.; Kajiwara, Y.; Nakamura, O.; Minami, T., Reconstruction of the 3-D shape of an object from a 2-D intensity image, Canadian Conference on Electrical and Computer Engineering, 1995. Volume: 2, 5-8 Sep 1995 Pages: 1188-1191, provided by applicant, "Numagami" hereinafter) as applied to claim 12 above, and further in view of Nakatsuna et al. (U.S. Patent Publication No. 2002/0154116).

Regarding claim 14, Numagami also teaches that "cost values corresponding to respective pixels of the image are successively computed on basis of further cost values being computed for further pixels" (i.e., pixel values are calculated by linear interpolation of neighboring pixels, see section V, 8th par.). Numagami does not teach "a first scan direction of successive computations of cost values for a first row of pixels of the image being opposite to a second scan direction of successive computations of cost values for a second row of pixels of the image". Nakatsuna, however, teaches a method of interpolating depth values on a pixel-by-pixel basis (see par. [0119] and

[0165]), in which the pixels are evaluated in a zigzag path, so that pixels may be positioned in a two-dimensional neighborhood (see par. [0179]).

Because both Numagami and Nakatsuna disclose linear interpolation for calculating pixel values, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the linear interpolation of depth values as disclosed in Numagami, with the zigzag inspection path disclosed in Nakatsuna. Such an approach would be representative of the well known principle of locality in program optimization, by which it is advantageous to perform tasks in such an order that the values that have just been calculated and are therefore readily available, are those needed to perform the next calculation.

Conclusion

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Carlos Perromat whose telephone number is (571) 270-7174. The examiner can normally be reached on M-TH 8:30 am- 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kee M. Tung can be reached on (571)272-7794. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kee M Tung/
Supervisory Patent Examiner, Art Unit 2628

Carlos Perromat
Examiner
Art Unit 2628

C.P.